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**(54) WATER-BASED INK COMPOSITION FOR WRITING UTENSIL**

(57) A water based ink composition for a writing instrument comprising at least a colorant, water and a liquid medium, wherein reduced maltooligosaccharide

and/or reduced isomaltooligosaccharide are added in a proportion of 0.5 to 20 % by weight based on the total amount of the ink composition.

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## Description

## Technical Field

5 [0001] The present invention relates to a water based ink composition used for a writing instrument, more specifically to a water based ink composition for a writing instrument which is excellent in the prevention of clogging at a pen tip and drought resistance.

## Background Art

10 [0002] There has so far been involved the problem that in the case of a water based ink, if water contained therein is evaporated, dissolved substances and admixed substances contained in the ink are concentrated, deposited, dried and solidified at the point of the writing instrument to cause clogging and a rise in the viscosity of the ink so that troubles in writing are brought about.

15 [0003] Accordingly, it has so far been proposed to add a slightly volatile dye-solubilizing agent or dye-solubilizing auxiliary, such as urea, thiourea, polyhydric alcohols or derivatives thereof, tetrahydrofurfuryl alcohol, 4-methoxy-4-methylpentane-2-one, ethylene oxide adducts of p-toluenesulfonamide and thiodiethanol, alkanolamine, and sorbitol.

[0004] However, the respective additives described above have not been able to provide satisfactory water based inks because they have the problems that they do not have the sufficient drought resistant effect and have toxicity and therefore are not suitable as additives and that they allow the viscosities of the inks to grow large to bring about inferior follow-up of the inks.

20 [0005] Starch decomposition products having reducing end groups, oligosaccharides such as maltooligosaccharide and dextrin and maltodextrin represented by glucose polymers are nonreduced sugars, and therefore blending them into an ink has provided the problem that while a drought resistant effect at a pen tip is recognized, a reaction (Maillard reaction) between them and amino groups in a pH controlling agent and a water soluble resin which are ink components goes on with the passage of time to bring about the trouble that a pH of the ink is lowered.

25 [0006] The present invention has been made in light of the conventional problems described above, and an object of the present invention is to provide a water based ink composition for a writing instrument which is excellent in drought resistance at a pen tip and is safe and which does not vary in a viscosity and a pH.

## Disclosure of the Invention

30 [0007] Intensive researches repeated by the present inventors in order to solve the problems described above have resulted in finding that the problems described above can be solved by adding reduced maltooligosaccharide and/or reduced isomaltooligosaccharide to a water based ink composition for a writing instrument, and thus the present invention has been completed.

35 [0008] That is, the water based ink composition for a writing instrument of the present invention is characterized by adding reduced maltooligosaccharide and/or reduced isomaltooligosaccharide to a water based ink composition for a writing instrument comprising at least a colorant, water and a liquid medium.

## Best Mode for Carrying Out the Invention

40 [0009] The embodiment of the present invention shall be explained below in detail.

[0010] The reduced maltooligosaccharide and/or reduced isomaltooligosaccharide in the present invention are reduced products of maltooligosaccharide and/or isomaltooligosaccharide.

45 [0011] That is, the reduced maltooligosaccharide is a sugar alcohol of, for example, 2-saccharide to 10-saccharide obtained by reducing maltooligosaccharide.

[0012] Also, the reduced isomaltooligosaccharide is a sugar alcohol of, for example, 2-saccharide to 10-saccharide obtained by reducing isomaltooligosaccharide.

50 [0013] Those commercially available or those obtained by reducing maltooligosaccharide and/or isomaltooligosaccharide by a conventional method may be used for the reduced maltooligosaccharide and/or reduced isomaltooligosaccharide.

[0014] A content of reduced maltooligosaccharide and/or reduced isomaltooligosaccharide contained in the water based ink composition for a writing instrument shall not specifically be restricted and is suitably selected from a range of 0.5 to 20 % by weight, preferably 1 to 10 % by weight based on the total amount of the ink composition.

55 [0015] The content of less than 0.5 % by weight decreases an effect on the drought resistance, and the content of more than 20 % by weight increases the spinnability to lower the writing feeling.

[0016] Water used in the present invention is used as a principal solvent and includes ion-exchanged water and

refined water.

[0017] The liquid medium used in the present invention includes, for example, water-soluble organic solvents. To be specific, it includes alcohols such as ethylene glycol, diethylene glycol, triethylene glycol, propylene glycol, dipropylene glycol, glycerin and 2-propanol, and 2-pyrrolidone. They may be used alone or in suitable combination of two or more kinds thereof.

[0018] A use amount of the liquid medium shall not specifically be restricted and is suitably selected from a range of 3 to 40 % by weight, preferably 5 to 30 % by weight based on the total amount of the water based ink composition for a writing instrument.

[0019] The colorant used in the present invention shall not specifically be restricted as long as it is usually used as a colorant, and all which can be dissolved or dispersed in the liquid medium described above can be used and include, for example, pigments and dyes.

[0020] The pigments include, for example, organic pigments such as phthalocyanine pigments, azo pigments, perinone and perylene pigments, anthraquinone pigments, quinacridone pigments, dye lakes, nitro pigments and nitroso pigments, and inorganic pigments such as carbon black, titanium black, zinc oxide, red iron oxide, chromium oxide, black iron oxide, cobalt blue, yellow iron oxide, viridian, zinc sulfide, lithopone, cadmium yellow, vermilion, cadmium red, chrome yellow, molybdate orange, zinc chromate, strontium chromate, white carbon, clay, talc, ultramarine, precipitated barium sulfate, baryte powder, calcium carbonate, white lead, Prussian blue, manganese violet, aluminum powder and bronze powder.

[0021] The dyes include acid dyes such as Eosine, Phloxine, Water Yellow # 6-C, acid red, Water Blue # 105, Brilliant Blue FCF and Nigrosine NB, direct dyes such as Direct Black 154, Direct Sky Blue 5B and Violet BB, and basic dyes such as Rhodamine and Methyl Violet.

[0022] These colorants may be used alone or in suitable combination of two or more kinds thereof.

[0023] A use amount of the colorant shall not specifically be restricted and is suitably selected from a range of 1 to 40 % by weight, preferably 3 to 20 % by weight based on the total amount of the water based ink composition for a writing instrument.

[0024] When a pigment is used as the colorant, a dispersant is preferably used.

[0025] The dispersant includes water-soluble polymers or surfactants, and specific examples thereof include water-soluble polymers including anionic polymers such as polyacrylic acid salts, salts of styrene-acrylic acid copolymers, salts of styrene-maleic acid copolymers, salts of vinylnaphthalene-maleic acid copolymers and  $\beta$ -naphthalenesulfonic acid-formalin condensation products, and nonionic polymers such as polyvinylalcohol, polyvinylpyrrolidone and polyethylene glycol, anionic surfactants, nonionic surfactants and cationic surfactants. They may be used alone or in suitable combination of two or more kinds thereof.

[0026] A use amount of the dispersant is suitably selected from a range in which the properties of the water based ink composition for a writing instrument of the present invention are not damaged.

[0027] Further, components other than those described above may be added to the water based ink composition for a writing instrument of the present invention as long as the properties of the above water based ink composition are not damaged.

[0028] The components which can be added include, for example, fungicides such as sodium benzoate, Bioden-18, Amorden-HS, Amorden BT-50 and Amorden FS-14D (all manufactured by Daiwa Chemical Industries Co., Ltd.), Proxel BDN, Proxel GXL and Proxel TN (all manufactured by Zeneca Co., Ltd.), pH-controlling agents such as, for example, ammonia, aminomethylpropanol, triethanolamine, potassium hydroxide and potassium phosphate, viscosity-controlling agents such as, for example, polyacrylic acid salts and alginic acid salts, fatty acid alkali salts such as, for example, polyalkylene glycol derivatives, sodium oleate and potassium linoleate, lubricants such as nonionic surfactants and fluorine base surfactants, preservatives such as, for example, sodium omadine and 1,2-benzisothiazoline, rust preventives such as, for example, benzotriazole and saponin, defoaming agents and starving preventives.

[0029] The water based ink composition for a writing instrument of the present invention can easily be produced by dissolving, if necessary, with heating, mixing and stirring the components described above.

[0030] The water based ink composition for a writing instrument of the present invention is characterized by adding reduced maltooligosaccharide and/or reduced isomaltooligosaccharide to the above ink composition. The above reduced maltooligosaccharide and/or reduced isomaltooligosaccharide are non-toxic and safe saccharides which are usually used as an edible sweetening and are characterized by having a high solubility in water and very excellent water retention. Thus, the water based ink composition for a writing instrument of the present invention containing this reduced maltooligosaccharide and/or reduced isomaltooligosaccharide is safe and has been improved in drought resistance without causing the problem that the ink viscosity and the pH are vary with the passage of time.

[0031] Since the reduced maltooligosaccharide and/or reduced isomaltooligosaccharide do not exert an adverse effect on substances usually used for inks, they do not exert an adverse effect on the properties of the inks and do not change a hydrogen ion concentration in the inks, so that they do not exert an adverse effect as well on anionic and cationic substances. Accordingly, they have the advantage that a colorant can optionally be selected from all of water

base dyes and organic or inorganic pigments.

#### Examples

- 5 [0032] The present invention shall be explained below in further details with reference to examples and comparative examples, but the present invention shall by no means be restricted by the examples.

#### Example 1

- 10 [0033] The respective components were blended in the following proportion to prepare a water based blue ink for a ballpoint pen:

Phthalocyanine blue	8.0 % by weight
Styrene-acrylic acid resin ammonium salt	3.0 % by weight
Ethylene glycol	20.0 % by weight
Reduced maltooligosaccharide	5.0 % by weight
Phosphoric ester	0.7 % by weight
Bioden	0.3 % by weight
Aminomethylpropanol	0.3 % by weight
Benzotriazole	0.2 % by weight
Ion-exchanged water	balance

#### Example 2

- 25 [0034] The respective components were blended in the following proportion to prepare a water based blue ink for a ballpoint pen:

Phthalocyanine blue	8.0 % by weight
Styrene-acrylic acid resin ammonium salt	3.0 % by weight
Ethylene glycol	20.0 % by weight
Reduced isomaltooligosaccharide	4.0 % by weight
Phosphoric ester	0.5 % by weight
Bioden	0.3 % by weight
Aminomethylpropanol	0.3 % by weight
Benzotriazole	0.2 % by weight
Ion-exchanged water	balance

#### Example 3

- 40 [0035] The respective components were blended in the following proportion to prepare a water based black ink for a ballpoint pen:

Carbon black	8.0 % by weight
Styrene-maleic acid resin ammonium salt	3.0 % by weight
Reduced isomaltooligosaccharide	3.0 % by weight
Potash soap	0.5 % by weight
Propylene glycol	20.0 % by weight
Bioden	0.3 % by weight
Aminomethylpropanol	0.3 % by weight
Benzotriazole	0.2 % by weight
Cross-linking type acrylic acid polymer	0.4 % by weight
Ion-exchanged water	balance

## Example 4

[0036] The respective components were blended in the following proportion to prepare a water based black ink for a felt tip pen:

Carbon black	8.0 % by weight
Styrene-maleic acid resin ammonium salt	3.0 % by weight
Reduced maltooligosaccharide	3.0 % by weight
Ethylene glycol	20.0 % by weight
Bioden	0.3 % by weight
Aminomethylpropanol	0.3 % by weight
Ion-exchanged water	balance

## Comparative Example 1

[0037] The same procedure as in Example 1 was repeated to prepare a water based blue ink for a ballpoint pen, except that reduced maltooligosaccharide was removed in Example 1.

## Comparative Example 2

[0038] The same procedure as in Example 2 was repeated to prepare a water based blue ink for a ballpoint pen, except that 5.0 % by weight of urea was substituted for 4.0 % by weight of reduced isomaltooligosaccharide in Example 2.

## Comparative Example 3

[0039] The same procedure as in Example 3 was repeated to prepare a water based black ink for a ballpoint pen, except that 3.0 % by weight of non-reduced dextrin was substituted for 3.0 % by weight of reduced isomaltooligosaccharide in Example 3.

## Comparative Example 4

[0040] The same procedure as in Example 4 was repeated to prepare a water based black ink for a felt tip pen, except that reduced maltooligosaccharide was removed in Example 4.

## Evaluation test

## Test 1: evaluation test of inks for a ballpoint pen

[0041] Ballpoint pens having a ball diameter of 0.7 mm were charged respectively with the water based inks for a ballpoint pen prepared in Examples 1 to 3 and Comparative Examples 1 to 3 each described above and left standing with the caps detached, and the time passed until starving was caused was determined. Further, investigated were a changes in the viscosity at a shearing rate of  $38.4 \text{ s}^{-1}$  and the pH at the time of preparing the inks versus after stored at  $50^\circ\text{C}$  for one month. The results thereof are shown in Table 1.

Table 1

Evaluation test of water based inks for a ballpoint pen						
	Example			Comparative Example		
	1	2	3	1	2	3
Color of ink	Blue	Blue	Black	Blue	Blue	Black
Time passed until starving	30 days	30 days	15 days	15 days	20 days	15 days
Ink initial viscosity mPa·s	3.5	3.5	400	3.4	3.8	400
Viscosity change	None	None	None	None	Rise	None

Table 1 (continued)

Evaluation test of water based inks for a ballpoint pen						
	Example			Comparative Example		
	1	2	3	1	2	3
pH change <sup>1)</sup>	0.1	0.1	0	0.1	0.1	0.7

1) pH change: pH difference = (initial value) - (value after stored at 50°C/one month)

#### Comments on Table 1

[0042] As apparent from the results shown in Table 1, the water based blue inks for a ballpoint pen of the present invention obtained in Examples 1 and 2 and the water based blue inks for a ballpoint pen falling outside the scope of the present invention obtained in Comparative Examples 1 and 2 provided the equal results regarding a change in the pH's with the passage of time. However, the water based blue inks for a ballpoint pen obtained in Examples 1 and 2 had longer time passed until starving was caused and provided good results as compared with those of the water based blue inks for a ballpoint pen obtained in Comparative Examples 1 and 2.

[0043] Further, the water based black ink for a ballpoint pen of the present invention obtained in Example 3 and the water based black ink for a ballpoint pen falling outside the scope of the present invention obtained in Comparative Example 3 did not cause a change in the viscosities with the passage of time and provided the equal result regarding time passed until starving was caused. In the pH change, the water based black ink for a ballpoint pen obtained in Example 3 exhibited no change and provided good results as compared with those of the water based black ink for a ballpoint pen obtained in

#### Comparative Example 3.

[0044] In view of the foregoing it can be found that the water based ink compositions for a writing instrument of the present invention are apparently excellent.

#### Test 2: evaluation test of inks for a felt tip pen

[0045] Commercial felt tip pens were charged with the water based inks for a felt tip pen prepared in Example 4 and Comparative Example 4 each described above and left standing with the caps detached, and the time passed until starving was caused was determined. Further, investigated was a change in the viscosity and the pH at the time of preparing the inks versus after stored at 50°C for one month. The results thereof are shown in Table 2.

Table 2

Evaluation test of water based inks for a felt tip pen		
	Example 4	Comparative Example 4
Time passed until starving	12 hours	5 hours
Ink initial viscosity mPa.s	3.2	3.0
Viscosity change	None	None
pH change <sup>1)</sup>	0	0

1) pH change: pH difference = (initial value) - (value after stored at 50°C/one month)

#### Comments on Table 2

[0046] As apparent from the results shown in Table 2, both of the ink for a felt tip pen of the present invention obtained in Example 4 and the ink for a felt tip pen falling outside the scope of the present invention obtained in Comparative Example 4 did not change in the viscosity and the pH with the passage of time. However, the ink for a felt tip pen of the present invention obtained in Example 4 had longer time passed until starving was caused and provided good results as compared with that of the ink for a felt tip pen obtained in Comparative Example 4.

[0047] It can be found as well from this fact that the water based ink compositions for a writing instrument of the present invention are apparently excellent.

[0048] As described above, the water based ink composition for a writing instrument of the present invention exerts remarkable effects due to containing reduced maltooligosaccharide and/or reduced isomaltooligosaccharide in that it is very safe and is improved very much in drought resistance without varying the ink viscosity and the pH with the passage of time.

Industrial Applicability

[0049] The water based ink composition of the present invention has excellent drought resistance and is safe, and it does not cause a change in a viscosity and a pH and can be used for writing instruments such as ballpoint pens, marking pens and felt tip pens.

Claims

1. A water based ink composition for a writing instrument comprising at least a colorant, water and a liquid medium, wherein the ink composition comprises reduced maltooligosaccharide and/or reduced isomaltooligosaccharide.
2. The water based ink composition for a writing instrument as described in claim 1, comprising 0.5 to 20 % by weight of reduced maltooligosaccharide and/or reduced isomaltooligosaccharide based on the total amount of the ink composition.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP99/06342

A. CLASSIFICATION OF SUBJECT MATTER  
Int. Cl.<sup>7</sup> C09D11/16

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
Int. Cl.<sup>7</sup> C09D11/00-11/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP, 4-76074, A (Mikuni Shikiso K.K.), 10 March, 1992 (10.03.92), Claims; page 4, lower left column, lines 4-11; Examples (Family: none)	1-2
X	JP, 8-12916, A (PENTEL KABUSHIKI KAISHA), 16 January, 1996 (16.01.96), Claims; Par. No. [0012]; Examples (Family: none)	1-2
A	JP, 9-316378, A (DAINICHISEIKA COLOR & CHEMICAL MFG. CO., LTD.), 09 December, 1997 (09.12.97), Claims; Par. No. [0015] (Family: none)	1-2

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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Date of the actual completion of the international search  
01 February, 2000 (01.02.00)Date of mailing of the international search report  
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